

10 to 11 A.M. A glass (200 to 220 c.c.) of milk with a roll, one-half a cutlet, and a bit of boiled meat (160 to 168 grams).

12 to 12.30 P.M. A plate (220 c.c.) of chicken soup or a bowl of ordinary soup, sometimes with a bit of chicken from the soup, and a small cup of "kisel" (a sort of sour jelly); rarely, a little preserved fruit.

3 P.M. Tea with roll.

6 P.M. A cup of chicken or beef soup; semolina pudding or milk, a bit of chicken.

8 P.M. Milk with roll.

During the night: Coffee or tea with milk, two or four times; coffee with cognac.

In addition, the patients receive from one to three ounces of wine in the morning, and every two hours half an ounce of Stokes' mixture.

THE ETIOLOGY OF LOOSE BOWEL MOVEMENTS.

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BEFORE considering from a clinical standpoint the etiology of loose movements of the bowels, a brief statement of the physiological facts which have a bearing on the condition may be of service. In the intestinal tract we have to deal with a canal which is lined with various forms of glandular epithelium, and which has to perform the important functions of digestion, absorption, and, finally, elimination. Its activities are presided over by a sensitive nervous system energized from, and sympathetic with, the nervous centres in the cerebrum and cord. For its nutrition it is dependent upon the general blood and lymph stream, and is an early sufferer when these are at fault. Moreover, it is in direct communication with the external air, and becomes a culture ground for bacteria, some harmless, possibly even beneficial, while others are potentially dangerous and on occasions may be the cause of much disturbance and may even bring death to the whole organism. These functions and conditions are all mutually complimentary, so that disorder in one promptly leads to disturbance in the others.

As one of the by-results of the effective co-working of these functions, the majority of individuals secure one daily evacuation of fecal material of a soft-solid consistence, from which nutritive material has been almost entirely abstracted. In a few, evacuations may number two or three per day, and in another small group of individuals the frequency of the evacuations may be reduced to one every second

or third day. Both these conditions verge on the pathological, but so long as the general health in no way suffers and the movements are moderately firm in consistence, they can scarcely be said to demand interference on the part of the physician. An alteration in the consistence of the evacuations, however, must be regarded as more important. The contents of the small bowel are normally fluid and pass in from four to six hours from the stomach to the cecum. Considerable inspissation takes place in the ascending colon, and the now slowly moving contents of the transverse and descending colon acquire, under normal conditions, a distinctly firm consistence. The presence of an undue amount of water in the evacuations must, therefore, be regarded as indicative of some disordered function, the importance of which will vary according to the underlying cause, and to the systemic effects produced.

Looseness of the bowels, as it is popularly termed, may be dependent primarily upon: (1) Excessive propulsive peristaltic action; (2) an abnormal increase in the amount of secretion from the mucous membrane and secreting glands of the canal; and (3) defective absorption. These may work in a vicious circle. Increased peristalsis prevents absorption, and is often associated with increased secretion; increased secretion stimulates peristalsis and interferes with absorption; and defective absorption stimulates peristalsis, and is generally associated with some fault in secretion.

Although some physiologists regard true peristalsis as, in part, of myogenic origin, experiments indicate that it is, for the greater part at least, reflex in character, and that the stimuli which evoke it arise almost entirely from the bowel contents; these stimuli are directed and energized by the plexuses of Meissner and Auerbach, but are modified and controlled by impulses from the central nervous system through the vagus and splanchnic nerves.

Such stimuli may be the result of mechanical or of chemical irritation. The bowel contents act mechanically as stimulants to peristalsis by their bulk and by the coarseness and indigestibility of their particles. Chemical irritation arises for the most part from acidity or acridity in the contents; such acidity or acridity may develop as a result: (1) Of irritants introduced with the food; (2) from irritants the product of faulty digestion; or (3) from irritants developed from abnormal fermentation or other undue bacterial activity in the intestines.

The action of these stimuli will be increased by any abnormal irritability of the bowel wall including any inflammatory condition of the mucosa, or any excess of irritability in muscle fibers or in the nervous centres. Still further the influence of mental fatigue and mental emotions over the activities of both stomach and intestines is well recognized, especially in the hysterical and neurasthenic.

Secondly, undue fluidity of the evacuations may have as their primary cause excessive intestinal secretion. The secretions from the

stomach, the liver, the pancreas, and from the intestinal glands proper are, as we all know, very abundant, but in normal conditions much of their watery, and some of their solid, constituents are re-absorbed into the general circulation. Should absorption be impaired and true peristalsis be unduly active, this re-absorption takes place imperfectly and fluid movements will result.

All local irritants also to some extent stimulate secretion; some bacterial toxins appear to act in this way, producing excessive secretion of watery fluid, followed by copious evacuations, as for example, the rice water discharges of cholera. The presence of certain salines in the bowel contents also stimulates secretion and by osmotic action checks absorption. It must not be forgotten also that the large epithelial cells of the colon act as eliminating organs and that the toxins eliminated by them not infrequently stimulate peristalsis.

Loose evacuations may be primarily dependent upon defective absorption. Defective absorption may in some measure be due to imperfect digestion and preparation of the food for absorption. More important, however, is the interference due to conditions which interfere with the vital activity of the columnar cells lining the mucosa, to degenerative changes affecting the permeability of the walls of the intestinal blood vessels, and to any stasis of the portal or lymphatic circulation, all of which conditions may have an important place in the etiology of loose movements.

Closely associated with these conditions, sometimes as a cause and sometimes as a sequence, is an abnormal development of bacteria in the intestinal tract. Although the infant is reported to come into this world with sterile intestines, contamination of them quickly occurs, and the canal of an infant a few days old is said to contain a numerous flora. In the adult stomach numerous microorganisms, derived in part from the ingested food and in part from the air, are found. The intestines also, normally, contain many forms of bacteria to which the system has grown accustomed, and which are said to favor the natural digestive changes taking place in the intestine. In the small intestine no one form appears to be constantly present, but the flora varies from time to time according to the character of the diet. Most of the bacteria found in this portion of the canal appear to act on the carbohydrates in preference to the proteids. In the large intestine *Bacillus coli* is constantly present, and although ordinarily harmless, may at times vary much in virulence and in the toxicity of its products. To what extent these normal bacteria may induce disorder has not been fully determined. Their undue growth is held in check in the stomach by the presence of free acid and by the process of digestion proceeding with due rapidity; in the intestine, by the biliary acids, by the acids resulting from the decomposition of fats, and possibly by other digestive secretions, and also by the normal rapidity of intestinal

digestion and absorption. Disturbances of digestion and motility may antagonize or inhibit these preventive measures and either favor an excessive growth of such bacteria as may exist in the canal, or bring about a marked increase in their virulence. Under these conditions irritative conditions of the mucosa will surely develop.

With the introduction of new forms, and especially with the introduction of pathogenic bacteria, much disturbance often arises; but not always, for such may be either destroyed or rendered inert by the same natural defences which check the undue development of the normal flora. There is also considerable experimental and clinical evidence to prove that the normal bacteria of the intestine are distinctly useful in protecting the individual against new invaders.

In considering the etiology of loose evacuations from a clinical standpoint, we note first that loose evacuations may be occasioned by the mechanically irritating character of the food. It is generally recognized that coarse foods, fruits and vegetables containing much cellulose, berries and small fruits containing numerous seeds, by mechanical irritation of the mucosa stimulate peristalsis, and may, under conditions of increased susceptibility, lead to loose movements. The ingestion also of an unduly large amount of fatty food, such as oil and butter, may lead to increased peristalsis with the appearance of the unabsorbed fat in the motions. More important, however, as an etiological factor in the production of loose movements, is a faulty performance of the gastric functions. Both defective secretion and defective motility favor fermentation in the gastric contents and lead to the development of irritating organic acids and gases, and also to a great increase in bacterial growth. Hypersecretion with marked hyperacidity of the gastric contents may, by the discharge of extremely acid chyme into the duodenum, neutralize the normal alkalinity of the contents of the small intestine, and by so doing inhibit the action of the pancreatic enzymes, irritate the intestinal mucosa, and interfere with absorption.

The exact effect on peristalsis of intestinal indigestion due to deficiency in the secretion of the bile and pancreatic juice cannot be stated positively. Clinical and experimental studies have given contradictory results in the experience of different observers. Under normal conditions both appear to be secreted in quantities much in excess of actual requirements. A marked deficiency in the pancreatic secretion undoubtedly interferes with the splitting up of the fatty elements of the food, and consequently with their absorption and assimilation; it also interferes with the necessary changes which the proteid elements have to undergo to fit them for absorption. Any deficiency in the bile intensifies this condition as regards the fats. Experiments show that when the bile is absent, from 60 to 80 per cent. of the fats escape absorption, but digestion of the carbohydrates and proteids is only slightly interfered with. Of the succus entericus we know little.

In all conditions of impaired functional activity of the digestive secretions the development of a large bacterial flora promptly occurs, in part owing to the tardiness of the digestive process, and in part to the increased amount of nutritive material escaping unabsorbed into the lower portions of the intestine and affording a richer culture medium. Such development generally leads to loose movements associated with a varying group of other symptoms, but in the present state of our knowledge, we cannot definitely state that any one form of bacterial intoxication is the specific and only cause of any one particular group of symptoms.

In these conditions of impaired intestinal digestion as the result, in part, of defective absorption, in part, of the irritating changes taking place in the bowel contents reacting on a mucosa rendered unduly sensitive, and in part, of the direct action of bacteria or their toxins, peristalsis is generally unduly stimulated and the semifluid contents are hurried along without due inspissation.

Again, the clinical investigator must always bear in mind that in some individuals the intrinsic nervous mechanism of the intestines is particularly susceptible to impulses received from the large nervous centres in the cord and cerebrum. Emotion, worry, dread of any kind, and especially sudden fright, may evoke imperative loose movements: in some by increasing motility, in others by leading to profuse watery secretion, which by some physiologists has been likened to the sudden increase in the amount of saliva secreted under nervous influences. Chilling of the lower extremities may act in the same way. The morning diarrhoea of neurasthenic individuals is due apparently to some temporary irritable condition of the lower bowel, inducing one or two early morning evacuations which empty the lower bowel, and then do not recur for the day. Diarrhoeas attributable to this excessive nervous irritability are not infrequently observed in Graves' disease, in hysteria, and in neurasthenia.

Loose evacuations are occasionally due to a vicarious elimination of toxic products accumulating in the blood. It has been recently shown that the toxin of *Bacillus dysenteriae* injected hypodermically is eliminated by the large epithelial cells of the colon and is a potent cause of the diarrhoea. A diarrhoea of elimination may occur in many infectious fevers, in septicemia, in pneumonia, and in malaria. The diarrhoea of Bright's disease is well known to all. In gouty attacks any checking of the arthritic symptoms may induce diarrhoea. Sudden alteration of temperature may also induce diarrhoea, due in some measure to a sudden checking of the perspiration, and in part to reflex nervous influences.

Lastly, we may meet with loose evacuations due to disturbances of the blood or lymph circulations, such as the congestion associated with a failing right ventricle, or with a blocked thoracic duct.